University of Basel

Faculty of Science

Degree Profile

Master in Physics of Life

Organizational unit	Faculty of Science, Department Biozentrum
Degree	MSc Physics of Life
Scope, Duration, Start	90 ECTS, 3 semesters (if full-time), autumn or spring semester
Language of instruction	English

Program Goals

Students develop scientific knowledge of how methods and concepts from physics are used in life science research. They also learn to take an interdisciplinary approach to current research questions. They demonstrate their capacity to conduct their own research project by presenting the scientific results in written and oral form.

Program Characteristics

Orientation	Scientific-oriented education
Majors	–
Program Structure	The curriculum consists of the modules: Foundations in Physics of Life (18 ECTS), research projects (20 ECTS), Master's thesis (30 ECTS), Master's examination (10 ECTS), elective courses (12 ECTS).
Distinctive Features	Switzerland’s only degree program in Physics of Life is offered at the University of Basel by the Biozentrum, which is an internationally leading center for molecular life sciences. The program offers students a research-oriented education through courses and practical research projects. The practical research projects are made possible by the teaching staff who are engaged in research at the interface of physics and life sciences, located within the research groups of the Biozentrum and the other departments and associated institutes of the Faculty of Science, the Department of Biomedicine or the Department of Biomedical Engineering. Through the choices of research projects and the elective courses, students can design a program that aligns with their interests.

Career Opportunities

Employment	Basic research at higher education institutions, research institutes or in industry. Applied research in high-tech industry, chemical and pharmaceutical companies. Teaching, consultancy firms, patent law firms, science journalism.
Further Studies	Doctorate

Teaching

Approaches	Individual learning, problem-based learning, autonomous learning, research-oriented learning, theory-oriented learning, project work
Assessments	Oral and written examinations, written master's thesis, oral master's examination

Competences

Generic Attitude / Communication Approach / Management	Students acquire the skills to … – carry out independent and creative scientific research, from the idea through to communication. – organize the scientific work process efficiently through prior planning and setting of priorities. – analyze and document experimental data. – formulate hypotheses and test them through experimentation or simulation. – interact and work with a research team respectfully and responsibly. – deal responsibly with ethical aspects of the scientific work. – communicate ideas and results effectively in English language. – present scientific results and theories orally and in written form to specialist as well as public audiences. – lead scientific discussions and deal constructively with criticism. – write a concise and well-structured scientific text.
Subject-related Knowledge / Understanding Application / Judgment Interdisciplinarity	Students acquire the skills to … – carry out their own research projects focusing on a defined problem within the physics of life research field. – select, collate, critically analyze and evaluate relevant research literature in physics, mathematics, life sciences, and in the interdisciplinary literature that combines these fields of research. – perform teamwork in interdisciplinary research collaborations, and communicate effectively with scientists from the fields of molecular biology, computational sciences, chemistry, and physics, across disciplines. – analyze biophysical problems and identify solution strategies. – apply experimental or computational methods from physics, mathematics, or computational science to biological research problems. – understand advanced biological laboratory practices, analyses and experimental methods. – follow current trends in physics of life research at higher education institutions and in industry. – integrate new methodological and conceptual developments in molecular biology, biophysics, computational sciences, chemistry, or physics into their own research approaches. – perform quantitative and qualitative analyses of experimental data. – mathematically formulate biological questions and find suitable theoretical models and approaches. – plan biological experiments or simulations, execute them independently and document them. – understand and apply advanced scientific concepts in molecular biology, in particular from the biological area of their own research projects.

Learning Outcomes

Graduates of the master's program in Physics of Life ...

– possess scientific knowledge of the fundamental theories underlying molecular biology, in particular in the biological topics of their research projects, and are able to appropriately apply this knowledge to perturb or manipulate biological systems as well as systematically quantify the resulting changes.
– possess scientific knowledge of how physical, computational, and mathematical techniques can be applied to address research questions in life sciences, in particular in the biological topics of their research projects.
– possess the skills to communicate effectively at expert-level in interdisciplinary research collaborations, with scientists who have a background in physics, mathematics, computer science, or molecular biology.
– are able to select appropriate experimental or computational methods from physics, mathematics, computer science, and molecular biology to systematically test hypotheses in life science research.
– are able to critically evaluate scientific literature in physics, mathematics, computer science, molecular biology, and in the interdisciplinary literature that combines these research fields, to extract which concepts and methods should be applied for their research projects.

- are able to correctly describe the technical details of experimental and computational methods in accordance with a specified research problem and adapt them appropriately to new research questions and to different systems in order to provide scientifically-grounded positive and negative arguments for a given experimental or computational research approach.
- are able to correctly apply quantitative statistical data analysis methods in order to provide scientifically-grounded positive and negative arguments for testing a given experimental or computational research approach.
- are able to independently carry out a complete research project in the field of physics of life, including literature searches, the framing of research questions in the context of the current state of research in the field, conduct appropriate experimental or computational work, analyze the resulting data qualitative and quantitatively, and concisely present their results to peers as well as to the public in written and oral form according to scientific standards.
- understand the ethical aspects of their research work and can thus argue for the appropriate and responsible use of the scientific necessity of methods, such as animal experiments, handling of pathogenic organisms, or genetic modification of organisms.
- are able to use their experimental, computational, and analytical skills to evaluate the research work of others critically and respectfully, deal with constructive criticism of their own scientific results, and engage in a professional scientific discourse.